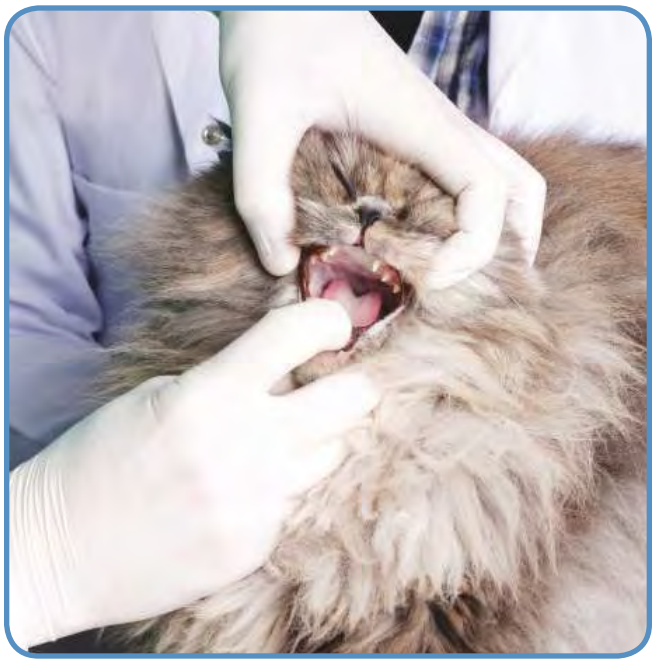
FELINE TOOTH RESORPTION



Brook A. Niemiec, DVM, FAVD, Diplomate AVDC

*This is the seventh article in the **Practical Dentistry** series, which is focused on teaching veterinary professionals how to provide high-quality dental care as well as communicate with clients in order to help them understand why this care is so important for their pets.*

*The first six articles in the series can be found at **todaysveterinarypractice.com** under **Article Lists**:*

1. ***Dental Services: Good Medicine for Patients & Practices*** *(September/October 2011)*
2. ***The Importance of Dental Radiology*** *(November/December 2011)*
3. ***Proper Therapy for Endodontic Disease*** *(January/February 2012)*
4. ***Periodontal Disease: Utilizing Current Information to Improve Client Compliance*** *(March/April 2012)*
5. ***Dental Extractions: Five Steps to Improve Client Education, Surgical Procedures, & Patient Care*** *(May/June 2012)*
6. ***Introduction to Oral Neoplasia in the Dog & Cat*** *(July/August 2012)*

Feline tooth resorption (TR), a common disease in cats characterized by resorption of the tooth by odontoclasts, has been through many different nomenclature changes; it was previously known as resorptive lesions, odontoclastic resorptive lesions, feline odontoclastic resorptive lesions, neck lesions, cervical line lesions, and cat cavities.

Feline TR is a very common problem. Incidence reports list a range from 30% to 60% for cats affected by this oral condition.[1,2] Risk factors include increasing age and the presence of other dental disease (including additional TR lesions).[3] Dental radiographs are required for proper diagnosis and treatment.

Treatment generally requires extraction, including proper pain management. By utilizing the information in this article, practitioners will improve the oral health of their feline patients while also improving practice income.

CLASSIFICATION

There are currently 3 recognized types of TR.[4-7] Clinically, all these appear very similar. However, it is currently believed that each type is a separate disease process; therefore, Type 1 TR does not progress to Type 2 TR.

Differentiation between each type is accomplished with dental radiology (see **Diagnosis**). Diagnosis and treatment of each type is directed by the radiographic appearance.

- **Type 1** lesions have no bony replacement of lost root structure (**Figure 1**, page 60).
- **Type 2** lesions generally involve marked replacement of the lost tooth structure with bone (**Figure 2**, page 60).[8]
- **Type 3** lesions present as a combination of types 1 and 2, with parts of the tooth showing type 1 characteristics and other areas showing type 2 characteristics (**Figure 3**, page 60).

ETIOLOGY

The etiology of TR lesions is not well understood. What we do know is that the resorption is caused by odontoclasts—cells that are responsible for normal remodelling of tooth structure.[5,7,9] These cells are activated, but then do not down-regulate, ultimately resulting in tooth destruction. The odontoclastic resorption generally begins on the root surface, destroying the cementum first and then the dentin. What is unknown at this point is what activates the odontoclasts.

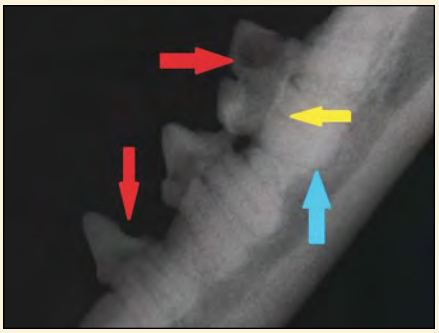


Figure 1. *Classic appearance of type 1 TR: There are large defects in these teeth (**red arrows**). However, the periodontal ligament (**blue arrow**) and endodontic system (**yellow arrow**) are intact. Complete extraction is necessary.*

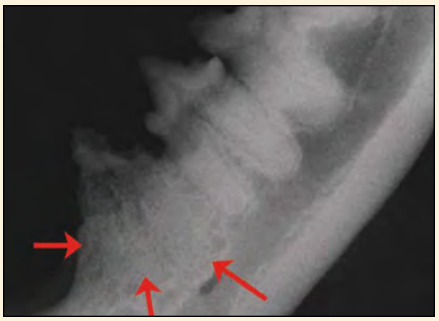


Figure 2. *Classic appearance of type 2 TR: There is significant to complete replacement of the root structure and no radiographically identifiable periodontal ligament or endodontic system is present (**red arrows**). This patient is a good candidate for crown amputation.*

Type 1 lesions commonly begin resorption on the coronal third of the root, but can begin further apically. As resorption progresses, the coronal dentin often becomes involved. Eventually, dentinal loss undermines the enamel, causing it to fracture and resulting in a defect in the tooth. Since type 1 lesions are typically associated with inflammation, such as caudal stomatitis or periodontal disease, it is believed that this soft tissue inflammation activates the odontoclasts.[4,10]

The etiology of **type 2 lesions** remains unproven. Currently, there are 2 theories:

1. Abfraction injuries from eating hard food (see **Theory of Abfraction**)[5]
2. Excess vitamin D in the diet.[9]

Whether various TR types are different manifestations of a common etiology or represent several different processes, separation into the 3 types is therapeutically useful.

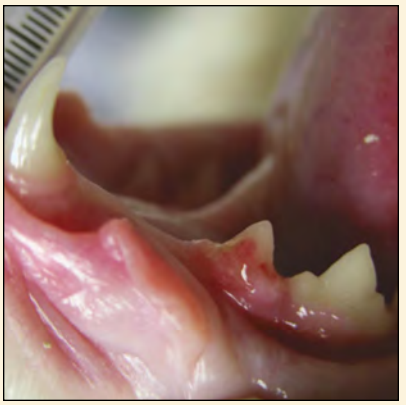


Figure 3. *Appearance of type 3 TR: Note the complete destruction of the distal root with a fairly normal mesial root. Courtesy AVDC.*
Figure 4. *Intraoral dental picture of type 2 TR on the mandibular left third premolar (307).*

CLINICAL PRESENTATION

Early lesions may not be clinically evident because only the root is involved and defects are located under the gum line.

Clinically evident TR presents as tooth defects that are first noted at the gingival margin, particularly with type 2 lesions (**Figure 4**).[5,7] The adjacent gingiva typically fills the defect and, thus, any area of gingival enlargement in cats is suspect for a TR lesion (**Figure 5**).

More advanced lesions show significant tooth destruction and resemble a fractured tooth (**Figure 6**).

- Advanced **type 2 lesions** may result in complete loss of the crown, creating a smooth, gingival covered "bump" (**Figure 7**, page 62).
- In cases of **type 1 lesions**, the weakened crown may eventually fracture, while the root canal system stays intact, resulting in ongoing pain and infection in the patient.[11]

As noted earlier, **type 1 lesions** are typically associated with inflammation. Although **type 2 lesions** are generally seen in otherwise healthy mouths, they often create local gingivitis.[10] The lower third premolar is commonly the first tooth affected and can be considered a *sentinel tooth*.[12] Once TR extends into the oral cavity (ie, above the gum line), it causes pain but cats rarely show clinical signs.[13]

DIAGNOSIS[4-8, 14-16]

- **Visual observation:** The first step in diagnosis of TR lesions is visual observation on oral examination. TR is generally seen as soft, tissue filled defects at or just above the gingival margin (**Figure 8**, page 62). The associated gingiva may appear normal or inflamed.
- **Tactile observation:** Reliable diagnosis of a lesion typically requires utilizing the tactile sense via a dental explorer.
  - » TR lesions feel hard and rough as opposed to furca-

THEORY OF ABFRACTION

This theory suggests that noncarious dental lesions are caused by flexural forces. As teeth flex under pressure, occlusion causes tension on one side of the tooth and compression on the other. This force is believed to cause V-shaped depressions on the side under tension and C-shaped depressions on the side under compression.

Figure 5. *(**A**) Intraoral dental picture of a TR on the left maxillary third premolar (207); note the gingival enlargement filling the defect. (**B**) Intraoral dental picture of a TR on the left mandibular canine (304); note the gingival enlargement filling the defect.*

Figure 6. *(**A**) Intraoral dental picture of severe TR on the left mandibular third premolar (307); the destruction has resulted in a crown fracture of the tooth. (**B**) Intraoral dental picture of severe TR on the left mandibular fourth premolar and first premolar (308 and 309); the destruction has resulted in a crown fracture of 309.*

tional lesions, which are smooth due to periodontally induced alveolar bone loss. Caries lesions (ie, true cavities) are soft, but are not reported in the feline.

» A dental explorer is used by placing it on the tooth just below the gingival margin at a right angle to the long axis of the tooth (**Figure 9**, page 62). The instrument is then run mesiodistal across the tooth surface to feel for rough areas. It is important to check all surfaces of the tooth.

- **Radiology:** Dental radiology is the best diagnostic tool for finding lesions and the only way to accurately differentiate between the types. Full-mouth radiographs are recommended in all cats 1 year of age or older (especially in cats over the age of 6) to avoid under diagnosis of these lesions.[17]

» **Type 1 lesions** (see **Figure 1**) display a radiographic appearance of normal root density in some areas and a well-defined periodontal space. The teeth typically have a definable root canal in the intact part of the tooth. Additionally, type 1 lesions are commonly associated with periodontal bone loss (either horizontal or vertical).

» **Type 2 lesions** (see **Figure 2**) show different radiographic density compared to normal teeth; the density is altered due to significant replacement resorption. Radiographic findings can vary to include areas with no discernable periodontal ligament space (dentoalveolar ankylosis) or root canal to those with little discernible root structure (ghost roots), which occurs in later stages (**Figure 10**, page 62).

STAGES OF TOOTH RESORPTION

A staging system has been recently developed by the American Veterinary Dental College to quantify the extent and location of the disease process (**Figure 11**, page 62).[6] While this information is important, it may not affect the treatment recommendations for tooth resorption.

TREATMENT[5-7,16]

When & How to Treat

In my opinion, treatment is not required in cases with no clinical evidence of TR (ie, root resorption is seen radiographically but no lesion can be seen/felt clinically). This recommendation stems from the fact that root resorption is not typically a painful process in humans.[18] However, if a tooth with only radiographic evidence of TR is not extracted, regular clinical and radiographic monitoring should be performed. If resorption is significant and near the gingival margin, prophylactic extraction should be recommended to avoid a painful lesion developing prior to the next dental procedure.

Historically, restoration of these teeth was recommended, especially with early lesions, and the restoration of choice was glass ionomer.[11] This therapy was based on the mistaken belief that these lesions were caries (cavities). We now know that, due to the progressive nature of these lesions, restoration carries a poor long-term prognosis; it is rarely performed today. Extraction is the current treatment of choice.

Extraction

Extracting teeth with TR can be very difficult due to tooth weakening and dentoalveolar ankylosis. In cases with significant weakening and/or ankylosis, a surgical approach is recommended to speed the extraction procedure and decrease the incidence of fractured and retained roots.[19]

Surgical extraction involves the creation of a gingival flap and removal of buccal cortical bone. Depending on the degree of ankylosis, a significant amount of bone removal may be necessary.

Crown Amputation

Crown amputation has been suggested as an acceptable treatment option for advanced type 2 lesions because

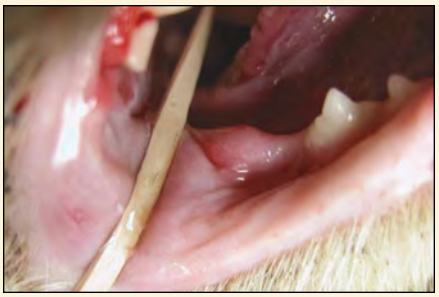


Figure 7. *Intraoral dental picture of severe TR on the right mandibular molar (409), which has fractured below the gingival margin; the gingiva has healed over the tooth resulting in a smooth bump.*

Figure 8. *Classic gingival-filled lesions on the right mandibular third and fourth premolars, which have lesions along the gingival margin.*

Figure 9. *The correct use of a dental explorer to feel for tooth resorption at the gingival margin.*

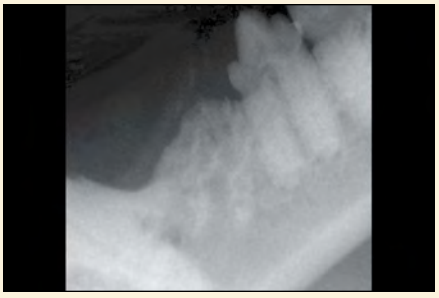


Figure 10. *Almost complete bony replacement of the left mandibular third premolar (307).*

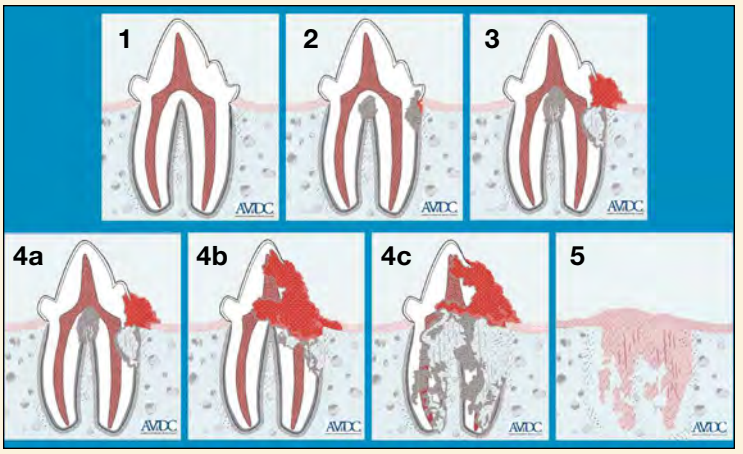


Figure 11. *AVDC Classification: Stages of TR*
Stage 1 *Mild dental hard tissue loss (cementum or cementum and enamel).* ***Stage 2*** *Moderate dental hard tissue loss (cementum or cementum and enamel with loss of dentin that does not extend to the pulp cavity).* ***Stage 3*** *Deep dental hard tissue loss (cementum or cementum and enamel with loss of dentin that extends to the pulp cavity); most of the tooth retains its integrity.* ***Stage 4*** *Extensive dental hard tissue loss (cementum or cementum and enamel with loss of dentin that extends to the pulp cavity); most of the tooth has lost its integrity.* ***Stage 4a*** *Crown and root are equally affected.* ***Stage 4b*** *Crown is more severely affected than the root.* ***Stage 4c*** *Root is more severely affected than the crown.* ***Stage 5*** *Remnants of dental hard tissue are visible only as irregular radiopacities, and gingival covering is complete.*
Courtesy AVDC

these lesions are being completely resorbed and have no identifiable root canal system. In these cases, crown amputation results in significantly less trauma and faster healing as compared to complete extraction.[20]

This procedure, although widely accepted, is still controversial. Veterinary dentists typically use this treatment option only when there is significant or complete root replacement by bone. In contrast, the majority of general practitioners use this technique far too often, which can ultimately leave painful and/or infected roots in the patient's mouth.

Therefore, crown amputation should be reserved for patients with (see **Figure 2**):[19]

- Advanced type 2 TR, confirmed by radiographs
  - » Dentoalveolar ankylosis (lack of radiographically identifiable periodontal ligament)
  - » No recognizable root canal system
- No evidence of endodontic disease (lack of periapical rarefaction)
- No evidence of periodontal disease (alveolar bone loss)
- No presence of caudal mucositis/stomatitis.

Crown amputation should **never** be performed in patients with (**Figure 12**):[19]

- Type 1 TR
- Radiographic or clinical evidence of endodontic or periodontal pathology
- Caudal stomatitis.

Dental radiographs are essential to differentiate type 1 and type 2 lesions. Therefore, practitioners without dental radiology capability should NOT perform crown amputation.[8] In these cases, the affected teeth should either be fully extracted (ie, with

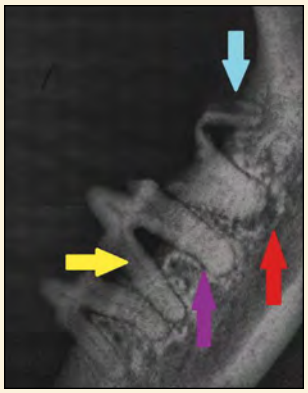


Figure 12. *Intraoral dental radiograph of the mandibular left of a cat with type 1 resorption: The third premolar (308) has an early lesion and the first premolar has been incorrectly treated with crown amputation, allowing the continuation of the periodontal and endodontic infection. Complete extraction is necessary in this case due to intact periodontal ligament (**purple arrow**), intact endodontic system (**yellow arrow**), periodontal disease as evidenced by the alveolar bone loss (**blue arrow**), and endodontic infection as evidenced by the periapical rarefaction (**red arrow**).*

the entire root) or the patient referred to a facility with dental radiology.[7]

When crown amputation is an appropriate choice, the procedure involves creating a small envelope flap in order to carefully cut the tooth off at the gingival margin. The tooth and bone are then smoothed with a coarse diamond bur on a high-speed handpiece. Finally, the gingiva is sutured closed, making sure there is no tension present on the suture line to allow for adequate healing.[19]

IN SUMMARY

- Feline TR is a very common condition that is known to be painful once the lesions extend above the gingival margin.
- A thorough dental examination and full-mouth radiographs are necessary for proper diagnosis and treatment and, therefore, general anesthesia is required.
- Discussions with clients should include sharing the information provided in this article in addition to other client educational materials in order to improve client compliance with treating these lesions, resulting in healthier feline patients as well as increased dental revenue for the practice.

TR = tooth resorption

References

1. Lommer MJ, Verstraete FJ. Prevalence of odontoclastic resorption lesions and periapical radiographic lucencies in cats: 265 cases (1995-1998). *JAVMA* 2000; 217(12):1866-1869.
2. Ingram KE, Gorrel C, Blackburn J, Farnsworth W. Prevalence of odontoclastic resorptive lesions in a population of clinically healthy cats. *J Small Anim Pract* 2001; 42(9):439-443.
3. Lund EM, Bohacek LK, Dahlke JL, et al. Prevalence and risk factors for odontoclastic resorptive lesions in cats. *JAVMA* 1998; 212(3):392-395.
4. DuPont GA, Debowes LJ. Comparison of periodontitis and root replacement in cat teeth with resorptive lesions. *J Vet Dent* 2002; 19(2):71-76.
5. Dupont GA. Problems with the dental hard tissues. In Niemiec BA (ed): *Small Animal Dental, Oral and Maxillofacial Disease: A Color Handbook*. London: Manson, 2010, pp 127-157.
6. Bellows J. Treatment of tooth resorption. *Feline Dentistry: Oral Assessment, Treatment, and Preventative Care*. Ames, IA: Wiley Blackwell, 2010, pp 222-241.
7. Niemiec BA. Oral pathology. *Top Companion Anim Med* 2008; 23(2):59-71.
8. DuPont GA. Radiographic evaluation and treatment of feline dental resorptive lesions. *Vet Clin N Am Small Anim Pract* 2005; 35(4):943-962.
9. Reiter AM, Lewis JR, Okuda A. Update on the etiology of tooth resorption in domestic cats. *Vet Clin N Am Small Anim Pract* 2005; 35(4):913-942.
10. Reiter AM, Mendoza KA. Feline odontoclastic resorptive lesions. An unsolved enigma in veterinary dentistry. *Vet Clin N Am Small Anim Pract* 2002; 32:791-837.
11. Wiggs RB, Lobprise HB. Domestic feline oral and dental disease. *Veterinary Dentistry: Principals and Practice*. Philadelphia: Lippincott Raven, 1997, pp 482-507.
12. Heaton M, Wilkinson J, Gorrel C, Butterwick R. A rapid screening technique for feline odontoclastic resorptive lesions. *J Small Anim Pract* 2004; 45(12):598-601.
13. Holmstrolm SE, Frost PP, Eisner ER. *Veterinary Dental Techniques*, 2nd ed. Philadelphia: Saunders, 1998, pp 481-493.
14. Lyon KF, Visser CJ, Okuda A, Anthony JMG. Feline stomatitis syndrome, periodontal disease, and feline odontoclastic resorptive lesions. In Deforge DH, Colmery BH (eds): *An Atlas of Veterinary Dental Radiology*. Ames, IA: Iowa State University Press, 2000, pp 159-170.
15. Niemiec BA. Dental radiographic interpretation. *J Vet Dent* 2005; 22(1):53-59.
16. Niemiec BA. Dental radiology. In Niemiec BA (ed): *Small Animal Dental, Oral and Maxillofacial Disease: A Color Handbook*. London: Manson, 2010, pp 63-87.
17. Niemiec BA. Case based dental radiology. *Top Companion Anim Med* 2009; 24(1):4-19.
18. Trope M, Chivian N, Sigurdsson A, Vann WF. Traumatic injuries. In Cohen S, Burns RC (eds): *Pathways of the Pulp*, 8th ed. St. Louis: Mosby, 2002, pp 103-144.
19. Niemiec BA. *Extractions Made Easy(ier).* San Diego: Practical Veterinary Publishing, 2012.
20. DuPont GA. Crown amputation with intentional root retention for advanced feline resorptive lesions: A clinical study. *J Vet Dent* 1995; 12(9):9-13.

Brook A. Niemiec, *DVM, FAVD, Diplomate AVDC, is chief of staff of Southern California Veterinary Dental Specialties, with offices in San Diego and Murrieta, California, and Las Vegas, Nevada. He has authored many articles and chapters, including the recently published* Small Animal Dental, Oral and Maxillofacial Disease: A Colour Handbook *(Manson Publishing). Dr. Niemiec founded the veterinary dental telemedicine website vetdentalrad.com, which also offers instructional videos and educational posters. He lectures extensively at national and international conferences and is the coordinator and instructor of the San Diego Veterinary Dental Training Center (vetdentaltraining.com). Dr. Niemiec received his DVM from University of California–Davis.*